Chapter Four

Habitats of Species of Greatest Conservation Need

Required Element #2: **Descriptions of the extent and condition of habitats and community types essential to conservation of species of greatest conservation need.**

Habitat availability, quantity, and quality are primary factors influencing the viability of wildlife populations. To protect and manage for species of greatest conservation need it is essential to identify the distribution of species within the state and the natural resources critical to their survival in and around occupied areas. Categorizing Iowa's habitat types and the SGCN species that depend on them will aid the design of effective management practices that will directly benefit Iowa's wildlife.

Organizing Frameworks – Ecoregions and Watersheds

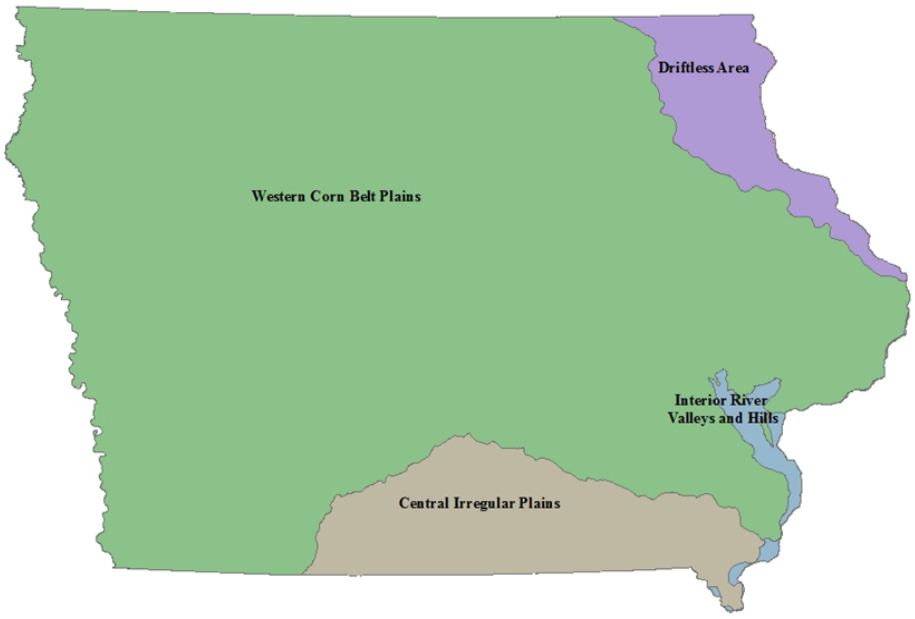
In addition to hierarchical systems for classification of lifeforms (taxonomy) and habitat types, geographic classification frameworks are also used to organize natural resource management, research, and planning activities. Over the years, natural resource agencies have moved from using political (e.g., county or state) boundaries toward the use of more holistic, ecosystem-based (e.g., watershed or flyway) frameworks for planning and delivering conservation. Due to this shift in methodology, many potentially useful ecoregional classification systems have been developed. Using biotic and abiotic ecological principles and processes, numerous authors have developed hierarchical ecoregional classification systems for a range of geographical scales (Cleland et al 1997). The Iowa Wildlife Action Plan is intended to provide useful information to users of watershed- and ecoregional-based approaches, and to illustrate the complementary use of these frameworks. Previous iterations of the Plan used the Landform Regions of Iowa (Iowa Geologic Survey, Iowa DNR) as a coarse-scale geographic framework, and watershed boundaries for some finer-scale analyses.

Ecoregions

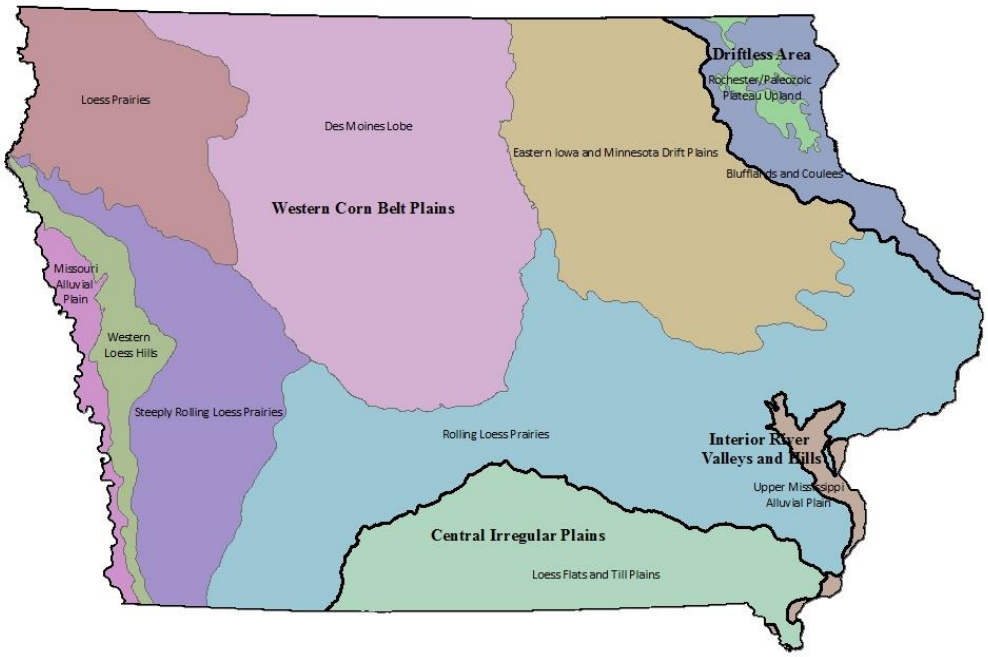
One limitation of the Landform Regions of Iowa is that it was developed specifically for management and planning use in Iowa and, thus, does not follow a consistent hierarchical

classification framework as other national ecoregional datasets. A variety of readily-available continental or national ecoregional datasets exist that were developed independent of political boundaries and are commonly used by conservation entities across the country. The Association of Fish & Wildlife Agencies (AFWA) recommends that for the development of State Wildlife Action Plans, resource managers "select classification systems, mapping units, and other such methodologies and data sources that will support the ultimate integration of SWAP priorities into future implementation of regional and national conservation initiatives…" (AFWA, 2012). Although developed at a coarser scale than the Landform Regions of Iowa (1:24,000), the Environmental Protection Agency (EPA) Ecoregions of the Continental U.S. (1:250:000) is a dataset capable of providing consistency for the development of SWAPs. For more seamless collaboration across state and federal lines, this Plan utilizes the EPA ecoregional framework for describing terrestrial and aquatic resources and conservation management and planning in Iowa (Maps 4-1 and 4-2).

Map 4-1. Environmental Protection Agency Level III Ecoregions of the Continental U.S. mapped in Iowa.



Map 4-2. Environmental Protection Agency Level IV Ecoregions of the Continental U.S. mapped in Iowa. (Large font denotes the names of Level III ecoregions and small font, Level IV ecoregions.)



Watersheds

A watershed is a geographic area of land for which all surface water (storm or base flow) drains or flows to a point of lower elevation. Watersheds come in many shapes and sizes and can be delineated at several scales. The U.S. Geological Survey has created and mapped a hierarchical classification of hydrologic units, individually identified at each successively smaller level by a Hydrologic Unit Code (HUC), for representing variable levels of surface drainage basins or distinct hydrologic features (available at: http://nhd.usgs.gov/wbd.html).

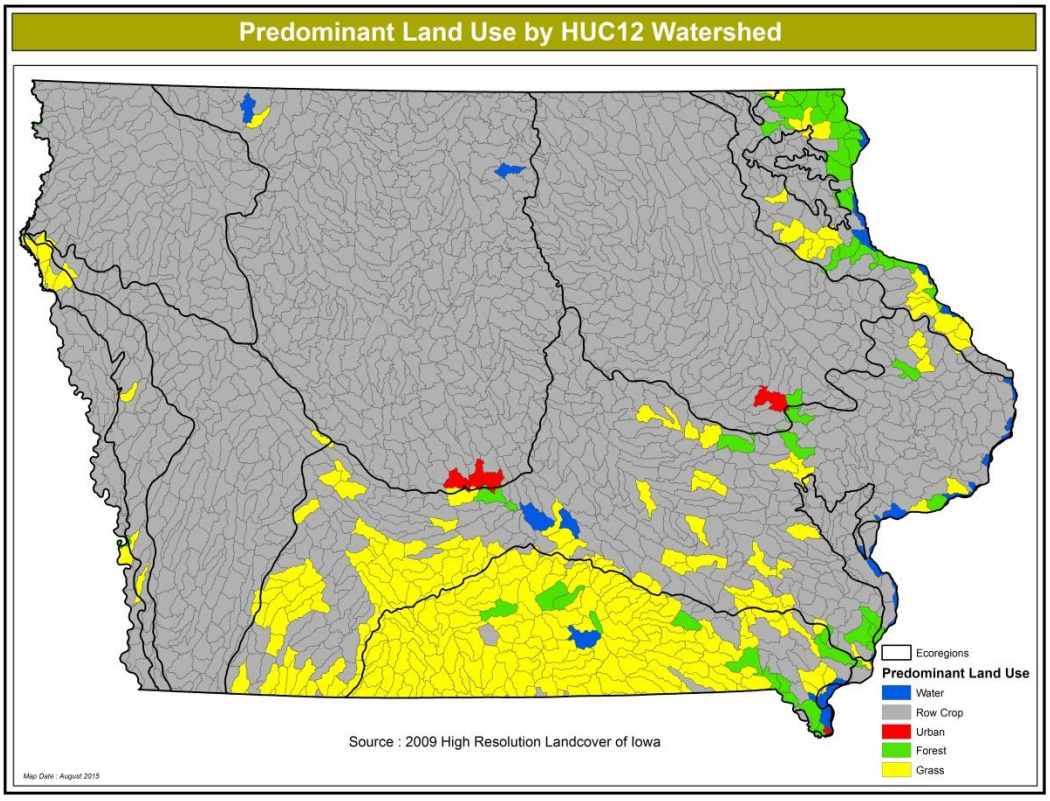
Watersheds are a useful spatial framework for establishing ecologically relevant boundaries for the evaluation of water quantity and quality, and subsequently aquatic habitats, across Iowa. The hierarchical nature of the HUC framework makes it scale-able to an issue of interest and the boundaries have been mapped and agreed-upon by most conservation entities in the U.S. Furthermore, HUCs are useful as units of evaluation because the water quantity and quality as measured at a given point along a flow line provides information about higher topographic areas from that point. Thus, the effects of natural processes or of management of land and water within a watershed can be evaluated. For these reasons, watersheds are used for a variety of analyses within this

Plan, particularly those analyses which specifically focus on aquatic organisms or require a finer spatial resolution than the ecoregions provide.

Organizing Frameworks – Terrestrial and Aquatic Habitat Classes

Iowa has a variety of land use and land cover datasets useful in analysis of the extent and location of Iowa's wildlife habitat. A look at the predominant land use by watershed provides a current overview of the big picture of Iowa's habitat (see Map 4-3).

Map 4-3. Predominant modern land use by U.S. Geological Survey Hydrologic Unit Code (HUC) 12 watersheds as determined from the 2009 Iowa High Resolution Land Cover.



Terrestrial Habitat Classes

The 2006 and 2012 versions of the IWAP utilized nine terrestrial vegetation classes defined by Iowa GAP as the basis for evaluating terrestrial wildlife habitats. Vegetation classes were mapped from digital remote sensing of 30 Landsat 5 Thematic Mapper (TM) images spanning 12 scenes across the state for obtaining statewide coverage and two to three

images per scene from between 1990 and 1994 (Kane et al. 2003). Given the extent of land use changes since 1990 and the lack of effort within the Midwest region to remap GAP land cover with recent satellite imagery, there has been a trend toward the use of newer land cover products (the Iowa Land Cover 2002 dataset (Kollasch 2005), and more recently, the Iowa 2009 High Resolution Land Cover (HRLC) dataset; available at: http://www.iowadnr.gov/Environment/GeologyMapping/MappingGIS.aspx) to inform our understanding of terrestrial wildlife habitats.

The habitat classes used in this plan were modeled after the Iowa 2009 HRLC which is described in Table 4-1 and provides more recently updated land cover information than those used in previous versions of the IWAP. A primary reason that this Plan utilizes a land cover classification as the basis for terrestrial habitat types is because it provides a means to more closely connect our monitoring framework with the current reality on the ground. To design wildlife monitoring programs that relate wildlife species distribution and trends to habitat types, it is necessary to periodically map land cover spatially in a Geographic Information System (GIS) using new or recent imagery for an area of interest. The use of outdated land cover has been a challenge for reliably modeling current or recent years' occupancy of SGCN by the Multiple Species Inventory and Monitoring Program, further described in Chapter 7.

Table 4-1. Description of the land cover classes mapped in Iowa's 2009 High Resolution Land Cover dataset.

Name	Description
Water	Spatial/spectral areas of open water, generally without any vegetation present. This class may occur in areas of shadow, or in recently cultivated bare ground.
Wetland	Spatial/spectral areas that are temporarily flooded or permanently wet. Some areas may be in crops in the summer NAIP imagery. This class generally reflects the presence of both a wetness signature and a vegetation signature.
Coniferous Forest	Spatial/spectral areas of evergreen forest. These areas show clearly as forest in the summer imagery, but are separated from deciduous forest by being very lush in the spring imagery. Late spring imagery, and imagery from certain sensors do not well separate conifers from other vegetation. In the 2007 and 2010 Spring imagery areas, when conifer discrimination is poor, a Landsat classification was used to coarsely separate Coniferous forest from Deciduous forest.
Deciduous Short	Spatial/spectral areas of broadleaf deciduous forest, trees or shrubs less than 3.5 meters (~15 feet) tall. (See Deciduous Tall)
Deciduous Medium	Spatial/spectral areas of broadleaf deciduous forest, or trees more than 3.5 meters (~15 feet) tall and less than 12 meters (~40 feet). (See Deciduous Tall)
Deciduous Tall	Spatial/spectral areas of broadleaf deciduous forest or trees more than

Name	Description
	12 meters (~40 feet) tall. Lidar normalized elevation data were used to stratify the deciduous forest class into three height classes, as listed.
Grassland 1	Spatial/spectral areas of grasses. Includes rural road ditch complexes, grassed waterways, some grassland/forest edge areas, and some tracts of grasses that are spectrally separable. This is the catch-all class for grasslands that are not otherwise separable into more detailed classes.
Grassland 2	Spatial/spectral areas of grasslands that exhibit lushness in their spectral signature in the spring image. This spectral response could be indicative of the absence of a heavy layer of senesced grasses, such as in areas grazed in the previous season, or in lawns. It might also be interpreted as representing cool season grasses that are lush in spring. This class includes hay which has not been recently cut.
Cut Hay	Spatial/spectral areas free or nearly free of vegetation in the summer image, and showing lushness in the spring image. This will usually represent alfalfa or hay fields that have been recently mowed, but is sometimes spectrally confused with barren areas, especially fallow fields. Probably the majority of the alfalfa on the landscape is included in the Grass 2 class. It was not readily separable in this product due to lack of spectral content.
Corn	Spatial/spectral areas of row crop planted to corn in 2009. This will include small amounts of spectrally confused areas planted to soybean or other crops. This class probably also includes some areas planted to uncommon classes, such as sorghum, etc.
Soybeans	Spatial/spectral areas of row crop planted to soybeans in 2009. Will include small amounts of spectrally confused areas planted to corn or other row crops.
Barren/Fallow	Spatial/spectral areas that are free or nearly free of vegetation in the summer image, and suggestive of row crop or bare soil in the spring image. Often these areas were characterized by early harvest (or no crop planted), and presented a bare soil aspect in the summer image.
Structures	Spatial/spectral areas that represent buildings, bridges, or other structures, with a minimum elevation of 3 meters (~10 feet).
Roads/Impervious	Spatial/spectral areas that are primarily parts of major roadways, rural asphalt or crushed rock roads, paved city streets and parking areas. This class may also occur in quarries and other areas of exposed rock, and in dry barren agricultural areas, as well as in sandbars.
Shadow/No Data	Spatial/spectral areas usually representing shadow from trees or buildings. Includes areas of missing data, usually due to the presence of cloud or shadows in the imagery. Often shadow pixels, especially those from buildings, are inseparable from water bodies, and are originally assigned there by the interpreter.

Natural resource managers implement conservation programs at a variety of scales. From a spatial standpoint, managers must consider scale for 1) both the pixel resolution (i.e., “grain”) and the spatial extent (i.e., 1:1,000,000 versus 1:24,000 scale), 2) the temporal period of data, 3) the

applicability of results across political or administrative boundaries, and 4) the ability to provide meaningful status, trend, and distribution data for a given program or species of interest. Typically, national land cover or land use datasets (e.g., U.S. National Vegetation Classification (FGDC 2008), GAP, CropScape (USDA-NASS 2014), National Land Cover Dataset (USGS 2014)) were developed at a relatively coarse pixel resolution (30-m or larger) which may mask habitat heterogeneity, may only provide an upper-level habitat classification (e.g., *Deciduous Forest*), represent land cover information from a temporal period too far past for application to current management and research efforts, or were developed for use at only regional- or landscape-scales (1:100,000 scale).

The 2009 HRLC represents the most recently available land cover information for the state and was developed at a fine pixel resolution (1-m and 2- to 3-m for county- and statewide-levels, respectively) rendering it suitable for more localized management efforts, although it does not provide a considerably more detailed land cover classification compared with national land cover datasets (upper-level; e.g., *Deciduous Tall*). Alternatively, the Terrestrial Ecological Systems of the United States (TES) spatial dataset provides a recently updated (2008) land cover classification at 30-m resolution, although at a finer mid-level ecological classification (e.g., *North-central interior dry oak forest and woodland*) than provided by the 2009 HRLC (Comer et al. 2003). The availability of fine resolution land cover, coupled with the recently updated mid-level ecological systems provided by the TES, provides the opportunity to combine these two datasets using established methods and available ancillary data (e.g., Soil Survey Geographic Database (SSURGO) and National Hydrography Dataset (NHD); Elliot et al. 2014).

In an ongoing effort, the IDNR is applying the TES ecological classification to the 2009 HRLC spatial data. A high-resolution, mid-level ecological classification system will allow state, federal, and local resource managers to identify focal areas for conservation and map areas of land at finer scales suitable for decision-making and management.

Table 4-2. Mid-level habitat classes of the Terrestrial Ecological Systems of the United States (TES) applicable to and mapped within Iowa. The use of ancillary spatial datasets can be used to apply these classes to the 2009 Iowa High Resolution Land Cover dataset and potentially develop refined subclasses nested within TES classes.

	Terrestrial Habitat Classes
1.	North-Central Interior Sand and Gravel Tallgrass Prairie
2.	Northern Tallgrass Prairie
3.	Great Plains Prairie Pothole
4.	Central Tallgrass Prairie
5.	North-Central Interior Wet Meadow-Shrub Swamp
6.	Eastern Great Plains Wet Meadow, Prairie and Marsh
7.	Introduced Wetland Vegetation
8.	North-Central Interior Dry Oak Forest and Woodland
9.	Great Plains Wooded Draw and Ravine
10.	Paleozoic Plateau Bluff and Talus

	Terrestrial Habitat Classes
11.	North-Central Interior Maple-Basswood Forest
12.	North-Central Interior Floodplain
13.	North-Central Interior Dry-Mesic Oak Forest and Woodland
14.	Developed-Open Space
15.	Developed-Low Intensity
16.	Developed-Medium Intensity
17.	Developed-High Intensity
18.	Open Water
19.	Agriculture - Pasture/Hay
20.	Agriculture - Cultivated Crops and Irrigated Agriculture

Table 4-3. Proportion of each land cover type mapped within Iowa from the 2009 High Resolution Land Cover dataset

Land Cover Type	Acres	Percent of Iowa
Agricultural & Grassland		
Corn	12,749,569	35%
Soybeans	9,714,462	27%
Cut Hay	206,298	1%
Barren/Fallow	251,334	1%
Grass 1 (road ditches, grass waterways, Conservation Reserve grassland)	5,020,967	14%
Grass 2 (uncut hay, lawns, pasture)	2,618,523	7%
All Agricultural & Grassland	**30,561,153**	85%
Forest		
Deciduous Forest Short	1,663,936	5%
Deciduous Forest Medium	1,004,894	3%
Deciduous Forest Tall	976,029	3%
Total Deciduous	*3,644,859*	*10%*
Coniferous Forest	126,072	0% (0.3%)
All Forest	**3,770,931**	**10%**
Developed		
Roads/Impervious Surfaces	771,398	2%
Structures	113,657	0% (0.3%)
All Developed	**885,054**	**2%**
Aquatic		
Wetlands	257,921	1%
Surface water	489,302	1%
TOTAL SURFACE AREA	**35,964,362**	**100%**

Distribution of Terrestrial Habitats

Wildlife habitats are not uniformly distributed throughout the state (Table 4-4). Agriculture dominates all ecoregions and ranges from 29% of the land cover in the Loess Flats & Till Plains ecoregion to 80% in the Northwest Iowa Loess Prairies ecoregion. The largest total proportions of wooded, grassland, and wetland habitats exist in the Loess Flats & Till Plains and the Paleozoic Plateau/Coulee Section ecoregions, and comprise 67% and 66% of the total land cover in each region, respectively. The Northwest Iowa Loess Prairie, Des Moines Lobe, and the Missouri Alluvial Plain contain the least total proportions

of wooded, grassland, and wetland habitats, which together comprise 17%, 19%, and 19% of the total land cover in each ecoregion, respectively.

Table 4-4. Proportion of 2009 Iowa High Resolution Land Cover major cover types by Environmental Protection Agency Level III and IV Ecoregions in Iowa.

			Major land cover classes for ecoregions, as a proportion of each ecoregion's land area				
Ecoregion[1]	**Acres in Iowa**	**% of State**	**Wooded**	**Grass land**	**Wetland**	**Total**	**Rowcrops + Hay**
40. Central Irregular Plains	3,620,563	10%	24%	41%	2%	67%	29%
40a. Loess Flats & Till Plains	3,620,563	10%	24%	41%	2%	67%	29%
47. Western Corn Belt Plains	30,171,226	84%	8%	18%	2%	28%	68%
47a. Northwest Iowa Loess Prairies	2,804,513	8%	2%	13%	1%	17%	80%
47b. Des Moines Lobe	7,814,565	22%	4%	12%	3%	19%	78%
47c. Eastern IA & MN Drift Plains	5,444,713	15%	7%	15%	1%	23%	73%
47d. Missouri Alluvial Plain	636,685	2%	4%	11%	3%	19%	75%
47e. Steeply Rolling Loess Prairies	3,337,773	9%	4%	19%	1%	24%	74%
47f. Rolling Loess Prairies	9,120,039	25%	13%	27%	2%	42%	54%
47m. Western Loess Hills	1,012,938	3%	19%	25%	1%	45%	52%
52. The Driftless Area	1,783,771	5%	27.5%	29.7%	2.7%	60%	36%
52b. Paleozoic Plateau/Coulee Section	1,492,085	4%	32%	31%	3%	66%	30%
52c. Rochester/Paleozoic Plateau Upland	291,686	1%	6%	23%	0%	29%	66%
72. Interior River Valleys & Hills	426,908	1%	14%	13.8%	8%	36%	50%
72d. Upper Mississippi Alluvial Plain	426,908	1%	14%	14%	8%	36%	50%
Total Acres	36,002,469	100%	-	-	-	-	-

[1]See Maps 4-1 and 4-2 for locations of ecoregions. See Chapter 2 for more detailed descriptions of ecoregions. Grasslands class includes pastures. The remainder of the landcover for each Ecoregion is a combination of developed areas and open water.

Aquatic Habitat Classes

The aquatic habitat types chosen for use in the IWAP are displayed in Table 4-5. In the natural world, there is no clear delineation between these aquatic habitat classes. Creeks grade into streams and streams grade into rivers. There are many sizes of water bodies between small ponds and large lakes. Shallow natural lakes, or open water marshes, provide a significant transition between lakes and streams. They are extremely sensitive to fluctuations in water quality, water level and invasive species. Aquatic classes may show differences in flow rate, bottom substrate, water quality and clarity, water temperature and dissolved oxygen content as well as differences in associated plant and animal species. Aquatic species utilizing vegetated herbaceous wetlands are included in the Wetland terrestrial habitat class (Table 4-1).

Defining aquatic habitat classes helps describe the ecological need of aquatic species in a way that allows conservationists to focus on undertaking conservation actions in the right places for the right species. In addition, the following classes are all able to be mapped and therefore these classifications can be used to stratify the survey designs for aquatic organisms.

Table 4-5. Aquatic Habitat Classes Used in the IWAP

Aquatic Habitat	Description
River	Large flowing bodies of water. Third order and lower (larger). The Mississippi is a 10th order river.
Stream **A. Warm Water** **B. Cold Water**	Smaller flowing bodies of water that serve as tributaries to rivers. The stream class includes first and second order streams. Also referred to as headwater streams.
On-stream Impoundment	Slowly flowing bodies of water formed from artificial damming of a river, or stream, generally less than 500 acres in size and having a watershed to lake ratio >80:1.
Federal Flood Control Reservoirs	Iowa has 4 federal flood control reservoirs: Saylorville, Red Rock, Coralville, and Rathbun.
Mississippi River Pools	Pools on the Mississippi River caused by the construction of the lock and dam system.
Backwater	Slow flowing bodies of water associated with larger river systems. Back-channel low-lying areas filled with water during high flow events but may be completely isolated from the river during low flow and may exhibit no flow during these periods. They are especially prevalent on the Mississippi River.
Oxbow	A sub-class of backwaters, they are water bodies formed in old river channels that are now cut off from the main channel and flow of a river.

Aquatic Habitat	Description
Lake **A. Natural** **B. Constructed**	Large bodies of water exhibiting little or no flow with emergent vegetation over less than 25% of the surface area. "Publicly owned lake" means any constructed or natural lake having a watershed acreage-to-lake surface area ratio of less than 80 to 1 and owned by an Iowa county or municipal government or by the state of Iowa. (IAC 571 Chapter 31)
Shallow lake	Open freshwater systems where maximum depth is less than 10 feet. Normally in a permanent open water state due to the altered hydrology of watersheds and unmanaged outlet structures that maintain artificially high water levels. May be fringed by a border of emergent vegetation in water depths less than 6 feet. When clear, they are dominated by emergent and submergent vegetation.
Pond	Smaller standing body of water, less than 10 acres in size.
Surface Mines	Surface mines are artificial water bodies in excavated basins, often the result of sand and gravel mining operations, or resulting from excavations to provide fill materials for roadway construction like overpass ramps on major highways.

Iowa has over 19,000 miles of interior rivers and streams. There are 87 cold water streams located in northeast Iowa with a combined length of 266 miles. The 25 largest interior rivers extend over 3,500 miles and numerous smaller creeks and streams feed each.

All interior rivers and streams are part of either the Mississippi or the Missouri River systems. The Mississippi River watershed is 38,860 square miles (69 % of Iowa's surface area). The Missouri River drains 17,379 square miles (31%).

An oxbow is formed when a river channel changes course and sediments block the entrance and exit of a meander in the old channel. Large oxbows are found along the Missouri and Mississippi Rivers and smaller, pond-like oxbows are found along many interior rivers and streams.

There are four U.S. Army Corps of Engineers flood control reservoirs on the Des Moines River (Saylorville and Red Rock reservoirs), the Iowa River (Coralville Reservoir) and the Chariton River (Rathbun Reservoir).

Natural lakes are most common in the Loess Prairies and the Des Moines lobe ecoregions. Thirty-one major natural lakes with a combined surface area of almost 29,000 acres and 17 marsh-like shallow lakes with over 3,000 acres of combined surface area are still present in Iowa in spite of the extensive drainage of the past 150 years.

Constructed lakes include recreational lakes, municipal water supplies, river impoundments and surface mine lakes. These are generally small; less than one-fourth of these are over 100 acres. More than 200 man-made dams on rivers, streams and creeks impound areas ranging from 15 acres to 19,000 acres.

There are more than 87,000 ponds statewide. Most are in the Rolling Loess Prairies and Central Irregular Till Plains ecoregions, south of Iowa Highway 92. Ponds are generally less than 10 acres. An estimated 53% of Iowa's surface water area is in private ownership, and that vast majority of that acreage is in farm ponds.

Wetlands are transitions between terrestrial and aquatic systems and have saturated soil for a majority of the growing season. All wetlands have three things in common: hydric soils, a hydrology, and the presence of aquatic plants. Many different wetland classifications exist. In general, wetlands can be classified as:

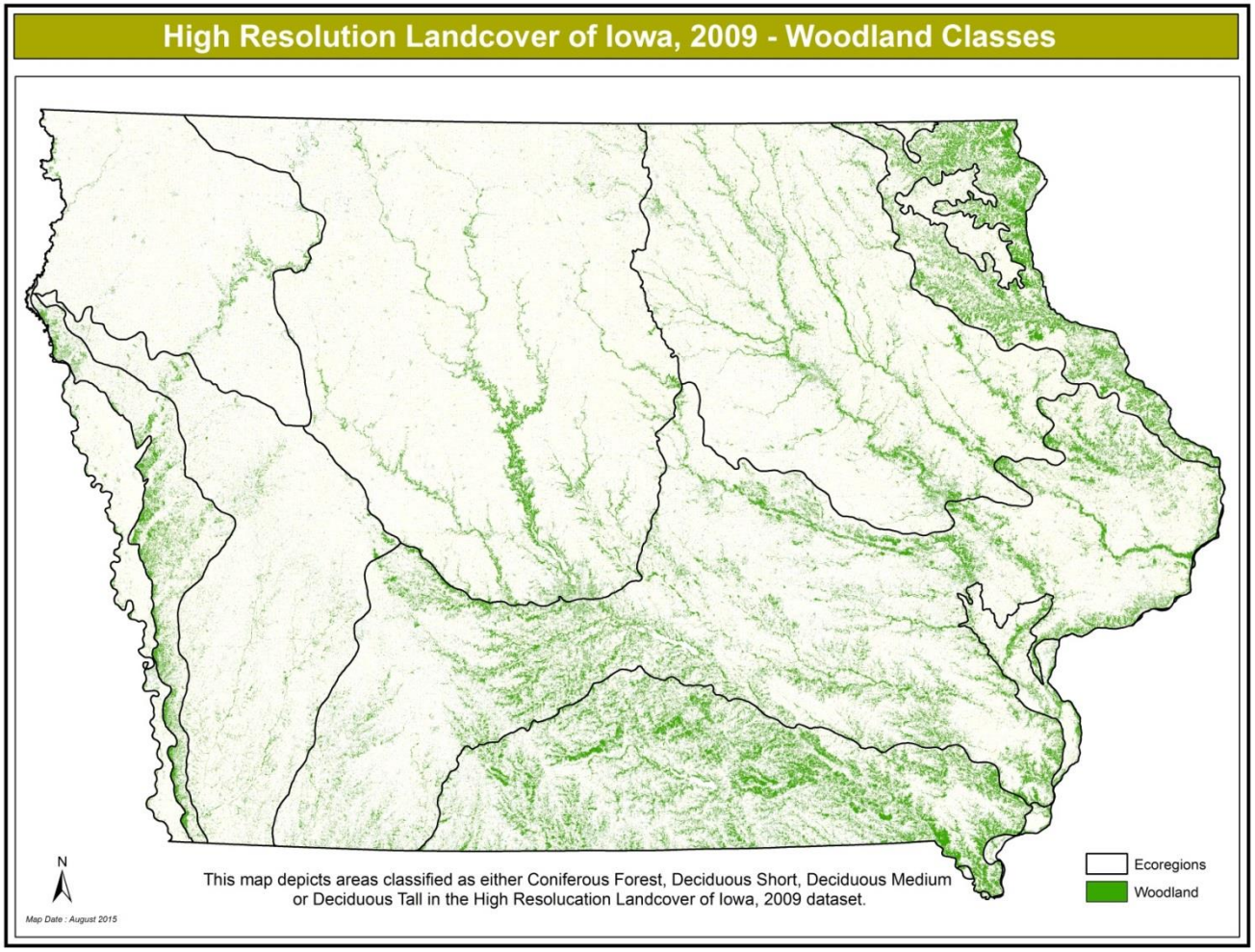
- Marshes, open and unforested wetlands dominated by cattails, sedges and grasses;
- Wet meadows which are dominated by sedges with very shallow water levels or are just saturated to soil level;
- Bogs and fens which are made up of unique living plants over partially decomposed organic matter (peat).

Wetlands in these categories are included with the terrestrial habitat classes under Wetlands (Table 4-1).

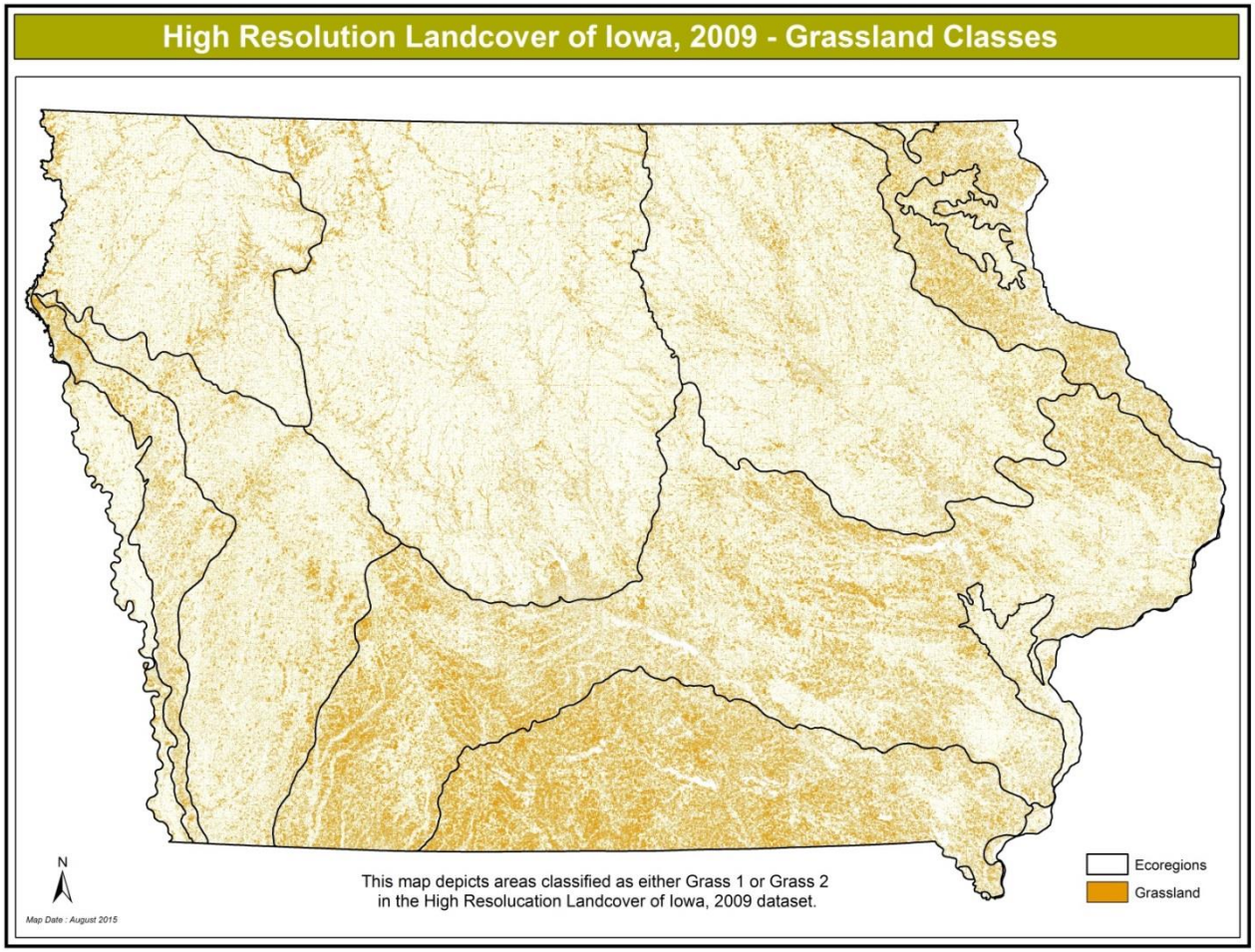
Habitat Maps

The maps on the following pages give a visual impression of the distribution of wildlife habitats, and they highlight two problems that are discussed later in the Plan. Most habitat blocks are small and highly fragmented compared to Iowa's original landscape. A century of sub-dividing the land for agricultural purposes has left few large blocks in any vegetative cover except for row crops. For example, 45% of Iowa’s forests exist in patches less than 100 acres in size (Flickinger et al. 2010). This has implications for area-sensitive species that require large blocks of habitat to survive or reproduce successfully. It may also make it difficult for less mobile species to pioneer new habitats or to find replacement habitat if their habitat patch is destroyed or altered unacceptably.

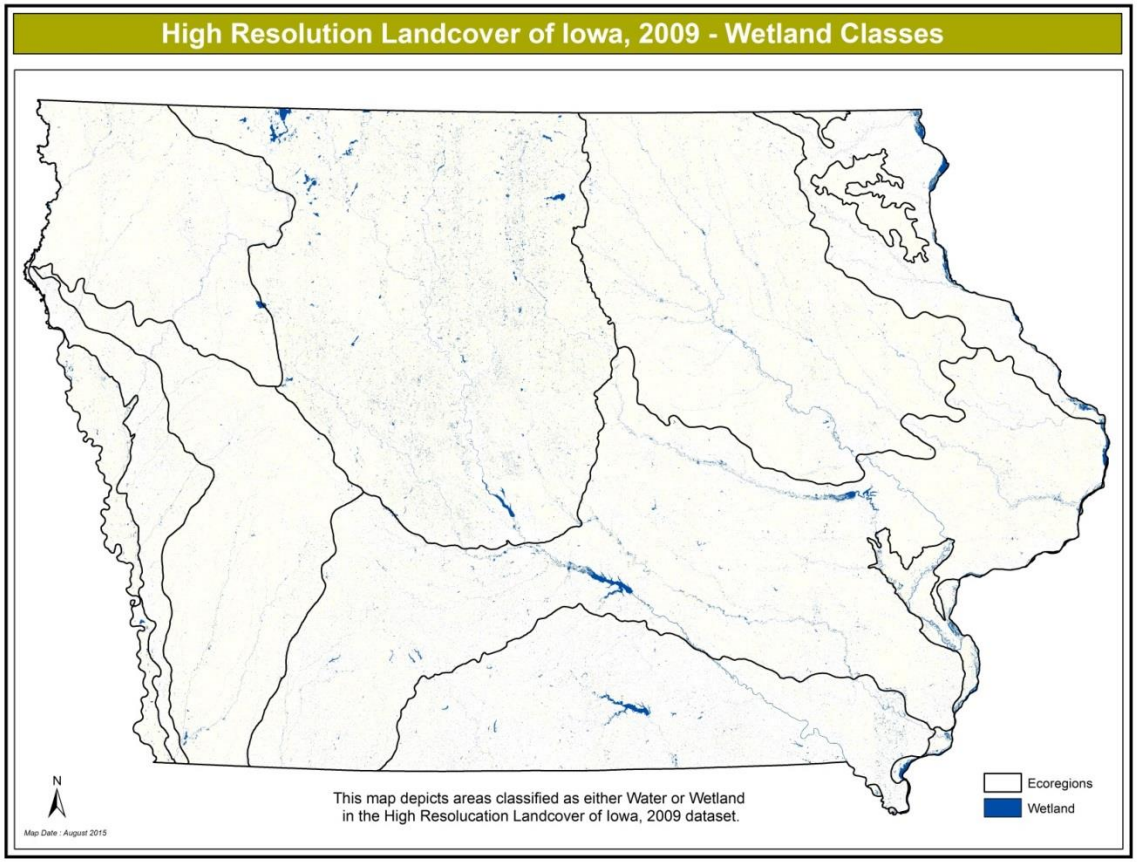
Map 4-4. Forest & Woodland Land Cover



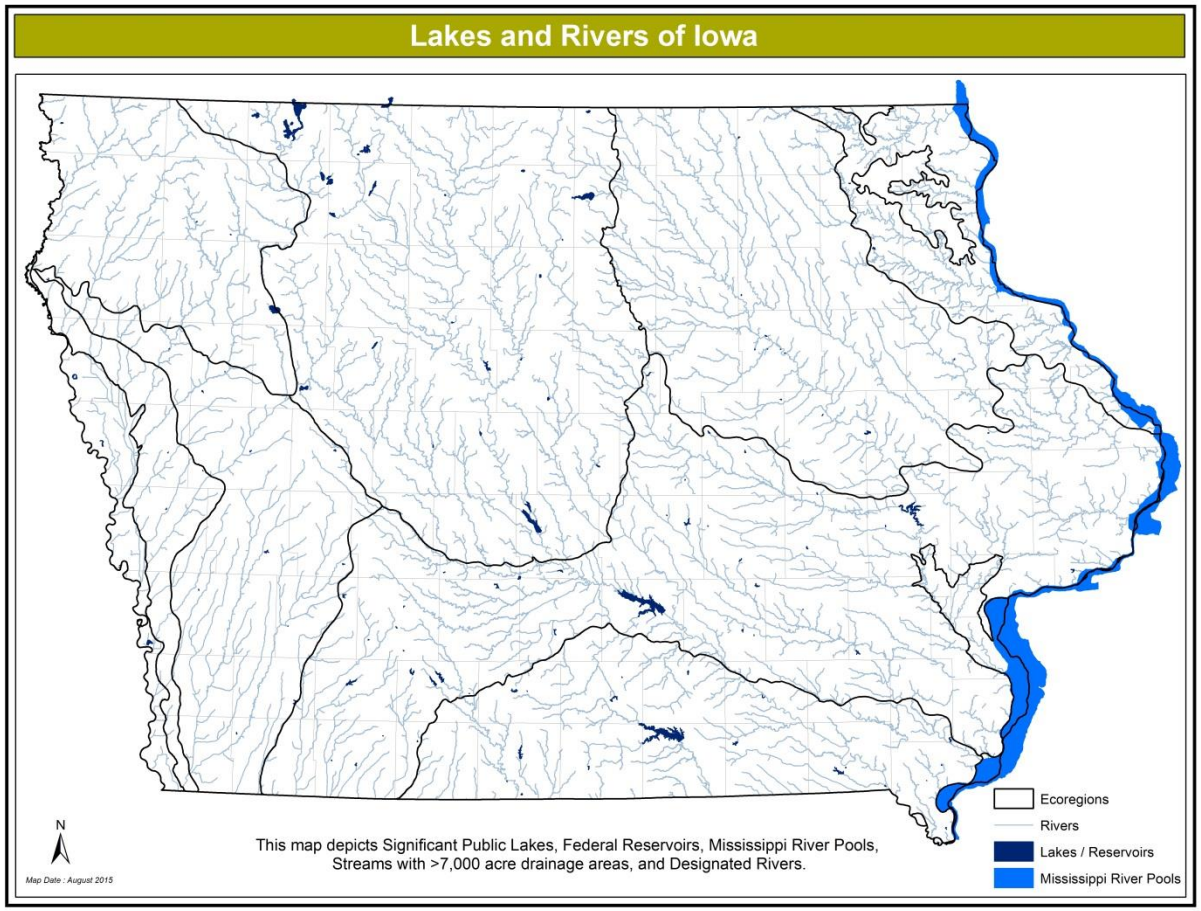
Map 4-5. Grassland Land Cover



Map 4-6 Wetland Land Cover



Map 4-7. Major Lakes and River Systems of Iowa (Source: Iowa DNR)



Habitat Preferences of SGCN

The Wildlife Working Groups' Taxonomic Subcommittees assigned each SGCN to a habitat class or classes. Aspects of each species' biology and behavior complicated this process. Some are generalists and can occupy a variety of habitats; others have very narrow habitat tolerances. Some species require different habitats at different stages in their life cycles, at different seasons of the year or at different times of the day. Working Groups identified those habitats that were considered to be the most critical or limiting to the species distribution and abundance in Iowa. Habitat preferences are taken from the existing literature and do not necessarily include all of the terrestrial and aquatic habitat classes listed in this Plan. Habitat preferences for individual SGCN are found in Appendix 18.

Appendix 19 displays SGCN with common habitat preferences grouped into the habitat classes used in this Plan. Species with more than one preferred habitat were listed in each class. Groupings of SGCN by habitat class give a very general overview useful for identifying habitat protection or restoration priorities at the landscape level. Detailed habitat management plans for SGCN must consider their entire individual habitat needs. Habitat management guidance documents are developed and updated as information becomes available, and therefore not provided within the Plan.

Flowing water aquatic habitats had the greatest number of SGCN of any habitat class, followed by wetlands (See Appendix 19, Table 19-11). The number of aquatic SGCN nearly equals the number of terrestrial species, yet surface water covers just 1% of Iowa. Aquatic and semi-aquatic taxa had the highest percentage of their species listed as SGCN (Table 3-2).

Priorities for Habitat Protection

Given the lack of natural areas remaining in Iowa, general strategies for prioritization of habitat protection tend to focus on enlarging the size of habitat complexes, reducing fragmentation, and increasing connectivity between larger areas of habitat. However, there are many species that have very specific habitat requirements, and some of those specialist species require habitats that are rare in Iowa or particularly sensitive to human disturbance. Thus, conservation of wildlife will require an approach that addresses both coarse-scale as well as fine-scale habitat needs.

Landscape-Scale Prioritization

Land protection not only provides habitat for wildlife and recreational opportunities for people, but also offers opportunities to maintain and restore ecosystem functions such as water filtration, flood abatement, carbon storage, etc. Intact ecosystems tend to

provide more benefits and are more resilient to outside stressors. Therefore, land protection efforts in Iowa should continue to focus on the following principles:

1. Development of functional landscapes – adding parcels to existing protected areas to create core areas of fish and wildlife habitat.
2. Decreasing fragmentation – using land protection to decrease the number of edges between habitat and non-habitat areas.
3. Increasing connectivity – protecting and/or managing for wildlife use of areas between existing habitat core areas to facilitate movement between these areas.
4. Protection of native sod – protecting and/or managing for remnant prairies or other areas which have not been previously plowed. (See Iowa Tallgrass Prairie Working Group, 2013 for more information on this principle and how it's applied.)

Rare and Sensitive Communities

Land protection and management efforts in Iowa should also continue to focus on preservation of rare and/or sensitive ecological communities, which in turn support rare wildlife species. Some of Iowa's unique landforms or natural communities are of global significance. For example, the Loess Hills of western Iowa comprise one of the most extensive Loess deposits in the world. Below are descriptions of important rare and sensitive communities in Iowa.

The following descriptions are all adapted from NatureServe Explorer (Faber-Langendoen et al. 2012).

1. Sand Prairie –This system is found in the northern Midwest, particularly in Minnesota, Wisconsin, Michigan, and possibly ranging into Ontario. It is often found on glacial features such as kames, eskers, moraines, lakeplains (though excluding the Great Lakes lakeplain) and sandplains, and along eolian dunes. In contrast to the deeper, richer soils supporting other tallgrass systems in the region, the underlying soils in this system tend to be more shallow, sandy, rocky, and/or gravelly outwash soils. Organic content is significantly lower. Fire and drought are the major dynamics influencing this system. If fire and periodic drought are not present, woody species begin to invade this system, especially in the eastern parts of its distribution. Wind can also play a role, especially on examples found on sandplains and/or eolian dunes. (From NatureServe North-Central Interior Sand and Gravel Tallgrass Prairie).

2. North-Central Interior Shrub-Graminoid Alkaline Fens - This fen system is found in the glaciated portions of the Midwest and southern Canada. Examples of this system can be located on level to sloping seepage areas, in pitted outwash or in kettle lakes associated with kettle-kame-moraine topography. Groundwater

flows through marls and shallow peat soils, and groundwater is typically minerotrophic and slightly alkaline. Examples of this system contain a core fen area of graminoids surrounded by shrubs. Alterations in wetland hydrology and agricultural development can threaten examples of this system. (From NatureServe Explorer - North-Central Interior Shrub-Graminoid Alkaline Fen).

Algific Talus Slopes and Goat Prairies - This system is found in the driftless regions of southeastern Minnesota, southwestern Wisconsin, and northern Iowa and Illinois. This region was not glaciated like the surrounding areas and thus is predominated by rolling hills and bluff outcrops. This system is found primarily on blufftops and dry upper slopes along the Upper Mississippi River. This system contains a mosaic of woodlands, savannas, prairies and sparsely vegetated limestone, dolomite, and/or sandstone outcrops, with occasional talus, especially algific talus. Soils range from thin to moderately deep and are moderately to excessively well-drained with a high mineral content. Historically, fire was the most important dynamic maintaining these systems, however, fire suppression within the region has allowed more canopy cover and thus very few prairie openings remain. Algific talus harbors a number of unusual Pleistocene relict species, including plants and snails. (From NatureServe Paleozoic Plateau Bluff and Talus).

3. Prairie remnants -
    a. *Central Tallgrass Prairies* - this system is found primarily in the Central Tallgrass Prairie ecoregion ranging from eastern Kansas and Nebraska to northwestern Indiana. This system differs from other prairie systems to the north and south by being the most mesic with primarily deep, rich Mollisol soils. These soils are usually greater than 1 meter deep. This system is dominated by tallgrass species such as *Andropogon gerardii*, *Sorghastrum nutans*, and *Panicum virgatum*. These species typically grow to 1-2 m tall in the rich soils found in this system. Other mid- and shortgrass species, such as *Bouteloua curtipendula*, *Hesperostipa spartea*, and *Schizachyrium scoparium*, are usually present and can be common or locally dominant on patches of this system, particularly slopes or other areas with drier habitats. Several forb species are also associated with this system making it one of the most diverse grassland systems. As many as 300 herbaceous plant species could occur in this system across its range. The environment and habitat of this system do not prevent invasion by shrubs and trees. High-quality examples of this system have trees and shrubs widely scattered or clustered in areas that are wetter and/or more sheltered from fire than the surrounding grassland. Fire, drought, and grazing are the primary natural dynamics influencing this

system and help prevent woody species from invading. However, conversion to agriculture has been the prime disturbance since post-European settlement. The rich soils and long growing season make this an ideal location for farming row crops, and as a result very few examples of this system remain.

b. *Northern Tallgrass Prairie* - This system is found primarily in the Northern Tallgrass ecoregion ranging along the Red River basin in Minnesota and the Dakotas to Lake Manitoba in Canada. It constitutes the northernmost extension of the "true" prairies. Similar to Central Tallgrass Prairie (described above) this system is dominated by tallgrass species such as *Andropogon gerardii*, *Sorghastrum nutans*, and *Panicum virgatum*. However, the soils in this region are not as rich or deep, and thus this system does not have as much species diversity as grasslands to the south. This system is often found on well-drained, drier soils. Grazing and fire influenced this system historically. Much of this system has been converted to agriculture with very few unaltered and highly fragmented examples remaining.

4. Great Plains Prairie Potholes - The prairie pothole system is found primarily in the glaciated northern Great Plains of the United States and Canada, and is characterized by depressional wetlands formed by glaciers scraping the landscape during the Pleistocene era. This system is typified by several classes of wetlands distinguished by changes in topography, soils and hydrology. Many of the basins within this system are closed basins and receive irregular inputs of water from their surroundings (groundwater and precipitation), and some export water as groundwater. Hydrology of the potholes is complex. Precipitation and runoff from snowmelt are the principal water sources, with groundwater inflow secondary. Evapotranspiration is the major water loss, with seepage loss secondary. Most of the wetlands and lakes contain water that is alkaline (pH >7.4). The concentration of dissolved solids result in water that ranges from fresh to extremely saline. The flora and vegetation of this system are a function of the topography, water regime, and salinity. In addition, because of periodic droughts and wet periods, many wetlands within this system undergo vegetation cycles. This system includes elements of aquatic vegetation, emergent marshes, and wet meadows that develop into a pattern of concentric rings. This system is responsible for a significant percentage of the annual production of many economically important waterfowl in North America and houses more than 50% of North American's migratory waterfowl, with several species reliant on this system for breeding and feeding. Much of the original extent of this system has been converted to agriculture, and only approximately 40-50% of the system remains undrained. (From NatureServe Great Plains Prairie Potholes).

5. Oak Savanna - This system is found primarily in the northern glaciated regions of the Midwest with the largest concentration in the prairie-forest border ecoregion. It is typically found on rolling outwash plains, hills and ridges. Soils are typically moderately well- to well-drained deep loams. This system is typified by scattered trees over a continual understory of prairie and woodland grasses and forbs. Quercus macrocarpa is the most common tree species and can range from 10-60% cover. The understory is dominated by tallgrass prairie species such as Andropogon gerardii and Schizachyrium scoparium associated with several forb species. Historically, frequent fires maintained this savanna system within its range and would have restricted tree canopies to 10-30%. Fire suppression in the region has allowed trees to establish more dense canopies. Periodic, strong wind disturbances and browsing also impact this system. Much of this system has also been converted to urban use or agriculture, and thus its range has decreased considerably. (From NatureServe North Central Interior Oak Savanna).

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